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Community compensation in the context of Carbon Capture and Storage: Current debates and practices

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ABSTRACT

Societal opposition has the potential to slow down the implementation of Carbon Capture and Storage (CCS). One of the difficulties is that the perceived benefits associated with a CCS facility for local communities tend to be low compared to its perceived burdens. As is the case for other low carbon technologies, community compensation (or community benefits) has been suggested as a way to restore this perceived imbalance. A diverse literature has looked into the role of community compensation across various land uses and research fields. Synthesis is limited, while at the same time, the provision of community compensation in practice is moving from an ad hoc to a more institutionalized approach. Therefore, it is important to take stock of the literature. This paper provides a review of the community compensation literature in the form of four debates, drawing together environmental social science research on different low carbon technologies (e.g. CCS, renewable energy). In addition, current practices in community compensation for four European countries are discussed. The two parts of this paper are brought together in a set of lessons for the provision of community compensation for future CCS projects; in turn, suggestions for further research are made to address remaining knowledge gaps.

1. Introduction

Carbon Capture and Storage (CCS) has long been part of the EU energy and climate change policy (De Coninck et al., 2009; European Commission, 2018), but despite successful implementation in some countries, such as Norway, CCS has not yet been implemented on a large scale in Europe. Moreover, in the Netherlands, Germany and the United Kingdom a number of large CCS demonstration projects were proposed but, in the end, failed to come off the ground since the early 2000s (e.g. Dütschke et al., 2015; Ministerie van Economische Zaken en Klimaat, 2017; Haszeldine, 2012; Littlecott, 2012).

Technical challenges, escalating costs and disappointing revenues have been pointed out as one of the reasons why implementation of CCS has been slow (De Coninck et al., 2009; Reiner, 2016). However, in addition to technical and economic challenges, lack of public support, public trust, and perceived unfair decision-making processes are thought to have played an important role in the cancellation of recent CCS projects (Ter Mors et al., 2010; Terwel et al., 2012; Terwel and Ter Mors, 2015). Thus, effective public engagement will be key for successful CCS implementation, with this comes a need for further insights into tools that can be used to engage with local publics (Ashworth et al., 2012; Dare et al., 2014; Mercer-Mapstone et al., 2018). This need is not unique to the CCS context, when it comes to the siting of low carbon developments (e.g. wind and solar energy, CCS, nuclear energy), an important challenge remains how developers and authorities can foster positive relationships with the local community (Aitken, 2010a).

Contributing to this challenge is the fact that the distribution of impacts of most low carbon technologies, including CCS, is not equal

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across society. The siting of new or expanded facilities is associated with mostly regional or (inter)national benefits (e.g. meeting energy and climate objectives, revenues) and mostly local burdens (e.g. potential economic losses, impacts on human health; Ter Mors et al., 2012). Projects may lead to less public resistance if there is a balance between local benefits and perceived negative impacts (Cass et al., 2010; Cowell et al., 2012; Gregory et al., 1991; Himmelberger et al., 1991; Kunreuther et al., 1993). Offering community compensation (or community benefits; host fees), may be one way to achieve this balance. Community compensation refers to "*any payment or exchange where there is reciprocity*" (Kerr et al., 2017, p.203). There are different types of community compensation, including monetary incentives (e.g. a grant to the local government, a community fund, tax rebates for local residents), and in-kind benefits or public goods (e.g. providing local employment, improving local infrastructure, constructing a park or cultural centre; Cass et al., 2010; Terwel and Ter Mors, 2015; Ter Mors et al., 2012). Furthermore, community compensation can serve different aims, sometimes in parallel, such as: fostering social acceptance, corporate social responsibility (i.e. being a good neighbour), compensating for impacts (e.g. on people or nature), mitigating potential problems, or providing rewards to the host community for assuming risks and costs associated with a facility (Ter Mors et al., 2012; Cass et al., 2010; Kojo and Richardson, 2014; Cowell et al., 2012). A distinction can be made between a 'narrow' notion of community compensation as a mechanism based on tort law principles (i.e. related to specific losses or damages), and a 'wide' notion of compensation offering a range of benefits to individuals or communities (Jørgensen et al., 2020). The current paper will mostly focus on the latter form of compensation.

Research on community compensation is an emerging field. While previous studies in the CCS literature have either implicitly or explicitly recognized the opportunity of community compensation (see Ter Mors et al., 2012 for an overview), the majority of research on community compensation has been conducted outside the CCS literature (e.g. wind energy). At the same time offering community compensation for the siting of low carbon developments is becoming more commonplace in the field (cf. Aitken, 2010a; Bristow et al., 2012), and will likely also be considered when implementing CCS. To understand how community compensation can be used when implementing CCS in society we need to learn from relevant projects and technologies and ensure that important insights are used. For instance, from findings obtained in the context of other low carbon technologies (e.g. renewables, nuclear energy), subsurface activities (e.g. gas extraction) and other land uses that impact local publics (e.g. infrastructure, landfills). Although each technology presents a specific context there are parallels with CCS as well. Importantly, the perceived imbalance between (negative) local impacts and national or global benefits, mentioned at the start of this paper, offers a challenge when it comes to public responses towards these technologies. The parallels between these different technologies are reflected by the similar debates and current practices in community compensation within each field which are brought together for the first time in this paper. Moreover, this paper will address current knowledge gaps on how community compensation may contribute to preventing or solving CCS siting controversies (Ter Mors et al., 2012), and the role different forms of community compensation could play (Ashworth et al., 2012).

The main focus of this paper will be a literature review that will outline current debates on community compensation in the academic literature (Section 2). Thereafter, we change focus to the use of community compensation in the field by discussing examples of current practices in community compensation for four different European countries (Section 3). This adds to the academic literature review as it allows for further insight into what community compensation measures for CCS may look like in practice, and which potential pitfalls to avoid. Overall, by identifying debates in the literature and discussing examples of compensation practices we aim to come to a set of lessons and remaining knowledge gaps for community compensation in the context of CCS (Section 4). These findings can provide a useful tool for researchers in this field looking to close knowledge gaps. Moreover, by taking this two-part approach this paper will also be of interest to stakeholders (e.g. project developers; authorities) wanting to understand how to make use of community compensation in the CCS context.

2. Academic debates on community compensation

The approach to the literature review was to examine current conversations around community compensation in the academic community, specifically focusing on recurring topics and key issues, as well as the research questions that have remained unanswered. In the next sections these topics, issues and questions are discussed, summarised into four 'debates'. When it comes to using community compensation in the CCS context, these debates help to provide a better insight into those topics and questions surrounding community compensation where there is (some) consensus, and those where further research is needed. The review covers a broad range of studies and review papers from different fields in the social environmental sciences (e.g. human geography, environmental psychology) discussing community compensation in the context of CCS, but also other low carbon technologies (e.g. renewables, nuclear energy), subsurface activities (e.g. gas extraction) and other land uses that impact local publics (e.g. infrastructure, landfills). Although we aim for a comprehensive overview of the academic literature, this review should not be interpreted as a 'systematic literature review' as we did not intend to do an exhaustive review covering all studies conducted on this topic. In Sections 2.1–2.4 the literature is summarised and discussed using the following debates: 1) Finding a 'fit' between the form of compensation and local needs and concerns; 2) Seeing community compensation as a part of the public engagement process; 3) The institutionalization of community compensation; 4) Community compensation for onshore and offshore developments.

2.1. Finding a 'fit' between the form of compensation and local needs and concerns

Previous research indicates that for community compensation to be effective, the type of compensation offered needs to fit with the local community's needs and concerns (Ashworth et al., 2012; Jørgensen et al., 2020; Ter Mors et al., 2012). However, achieving this fit is not easy, especially given the complex and contested nature of community described by various scholars, as well as the variety in values different communities attach to different places. That is, there is a discussion around how to determine who the relevant community is and how their needs and concerns should be identified (cf. Aitken, 2010a; Bristow et al., 2012; Reynolds et al., 2015).

In terms of defining the community, a distinction is sometimes made between communities of place, interest and impact (Bristow et al., 2012). Communities of place relate to communities in areas close to a development. Within communities of place there can be various communities of interest (i.e. communities based on shared interests; Bristow et al., 2012), meaning that communities of place are not necessarily cohesive groups of people with similar opinions, interests and needs. For instance, when surveying communities around wind turbines Walker and Baxter (2017) found that those opposed to wind energy were more interested in receiving compensation in the form of a reduction in electricity costs compared to those in favour of wind energy. These two groups also had different reasons for preferring certain forms of (financial) compensation. Another way of defining the relevant community is by assessing who is affected by the development (communities of impact; Bristow et al., 2012). However, a development can have many different impacts, ranging from purely aesthetic, to economic impacts (e.g. property values; tourism), health and safety. So, this approach leads to the question of which impacts should count. Offering community compensation to compensate for impacts has been critiqued as it implies that communities who do not oppose a facility do not deserve community compensation, while seeing community compensation as a

social obligation to correct imbalances is perhaps a more preferable rationale (Cowell et al., 2012). Moreover, linking level of compensation to level of harm provides the further challenging task of equating impacts in one domain with compensation in another.

The reason why this poses an issue is illustrated in research by Zaal et al. (2014); in this study a distinction is made between sacred values (e.g. human safety) and secular values (e.g. money). Exchanging a sacred value for a secular value, for instance by hosting a hazardous facility in exchange for monetary compensation, tends to be evaluated by the public as very negative. More positively evaluated are trade-offs whereby there is a clear compensation for the perceived risk, for example, a trade-off between a public harm and public good, rather than a public harm and monetary compensation (Zaal et al., 2014). This could explain why, in general, publics tend to be more accepting of non-monetary compensation compared to monetary compensation (Ter Mors et al., 2012). Other scholars have also highlighted this potential 'clash of values' (cf. Johansen and Emborg, 2018; Jørgensen et al., 2020; Upham and Pérez, 2015). For instance, when examining responses to Danish community compensation schemes for wind energy, Jørgensen et al. (2020) found that monetary compensation was sometimes seen as immoral as it could not address non-monetary burdens and concerns. People felt that the values which were lost, such as a tranquillity, were not commensurable with monetary compensation.

In fact, a place, community or landscape can hold a plurality of values and meanings for people, and finding the right form of compensation to account for a (perceived) threat to these values can prove difficult. Place in this context can be defined as a location that has meaning, in turn this meaning relates to notions of identity and sense of belonging (Cresswell, 2004). When something is seen to threaten what a place means this can lead to strong reactions (McLachlan, 2009), and developments can lead to opposition if initiators fail to see the important role of landscape, memory and beauty in achieving quality of life for local residents (Kempton et al., 2005). Examples of values and meanings related to place, and how these relate to representations of (low carbon) developments, can be found in the literature. Research on onshore wind showed that local residents value the landscape permanence of an area, seeing the landscape as something that remains unchanged and wind farms as something that threatens this permanence (Pasqualetti et al., 2002). Viewing energy technologies as 'industrialising the area', not fitting with the natural beauty of a place is also a recurring theme in research on place meanings and low carbon developments (cf. Devine-Wright, 2013). Similarly, interfering with nature was found to influence acceptance of CCS (L'Orange Seigo et al., 2014). A development can also be seen to enhance rather than threaten local values, and perceptions of place can be compatible with industrial developments (Devine-Wright, 2013; Whitmarsh et al., 2015). Previous experience (either positive or negative), or a local history, with particular industries could affect the meanings attached to a place. For instance, in a case study among farmers on CCS, familiarity with gas technology in the landscape (e.g. pipelines, gas wells), was cited as a reason for limited objection to a CCS development and a positive evaluation of compensation payments (Anderson et al., 2012). The importance of local history and meanings is also highlighted by Gough et al. (2017; 2018). They found high levels of trust in industry's ability to manage CCS among people in an area (i.e. Teesside, UK) that had a strong historical connection between industry and the local community. CCS technology was seen to fit with the long history of 'pioneering energy' in the area. In another area which lacked this historical connection (i.e. Lancashire, UK), any plans by industry were met with scepticism and compensation offers were seen as bribes (Gough et al., 2017; 2018). Overall, given the different values and meanings attached to place, Cowell et al. (2011) warn that it is morally inappropriate to use compensation as a means to justify action in the face of important and irreplaceable loss to values. Impacts caused by a development can only be legitimized based on other grounds.

In sum, scholars note that identifying the needs of local communities should include an explicit debate on values (Kempton et al., 2005). The latter recommendation fits within a wider literature discussing how relevant communities and their needs can be identified when discussing compensation measures in the context of new developments. First, the need for flexibility is an important theme: for any new development there is a need for flexibility at different levels (i.e. different stakeholders) and stages (i.e. implementation, communication) to adjust to the social context (Jørgensen et al., 2020; L'Orange Seigo et al., 2014). Specific concerns and needs will vary over time and across different regions, meaning that flexibility is needed to adapt to new social expectations (Dare et al., 2014; Gough et al., 2018; Jørgensen et al., 2020). For instance, by adjusting the project implementation strategy and framing of the project where needed in response to concerns raised by the local community (Ashworth et al., 2012). Second, meaningful community discussion (before plans are finalized) and insight into local social circumstances is another recurring topic, in order to identify local community compensation measures that are important and of value to local stakeholders (Ashworth et al., 2012; Brunsting et al., 2013). Processes such as these clearly place local communities at the centre of determining community compensation strategies, which takes us to the next debate in the literature.

2.2. *Seeing community compensation as a part of the public engagement process*

There is limited and conflicting empirical evidence that community compensation measures on their own can aid in reducing opposition and/or increasing acceptance for new developments (Aitken, 2010b; Gallagher et al., 2008; Walker et al., 2014). Further decision-making opportunities and public engagement measures (e.g. education, consultation, deliberation) are needed. Moreover, any community compensation measure is likely to be evaluated by local publics within the wider context of politics of project development and public engagement (Cass et al., 2010).

Research has pointed towards fairness surrounding the decision-making process and trust in developers and other key stakeholders as important factors influencing public responses to a development as a whole, as well as community compensation offers. Within research on this topic a distinction is often made between distributive and procedural fairness judgements. Distributive, or outcome, fairness relates to the equitable distribution of outcomes (e.g. public goods/burdens), while procedural fairness concerns the processes by which decisions are made (Gross, 2007). Distributive and procedural fairness, as well as trustworthiness judgements, are strongly linked (Jørgensen et al., 2020). As Aitken, 2010a notes, we cannot separate people's perceptions of a community compensation measure from their perceptions regarding the fairness of the decision-making processes, and feelings of trust placed in the project developer.

This debate also comes forward in the Social Licence to Operate (SLO) literature. SLO refers to the informal permission provided by the local community and broader society to industry to develop a technology; in the context of CCS the SLO has been recognised as highly provisional and fragile (Dowd and James, 2014; Thomson and Boutilier, 2011). According to Boutilier and Thomson (2011), SLO constitutes of four factors, one of which is economic legitimacy: the perception that the project or technology offers a benefit to the perceiver. This is very similar to distributive fairness described above. But, a SLO will not be achieved based on weighing costs and benefits alone, other factors play an important role as well. This includes whether a company acts fair and respects local ways of life (i.e. socio-political legitimacy), engages in mutual dialogue (i.e. interactional trust), and has an enduring relationship with community representatives with regard for each other's interests (i.e. institutionalized trust). Public engagement is considered the "*key vehicle for achieving a social licence*" (Dare et al., 2014, p.188).

So, these literatures together suggest clear benefits for including community compensation measures as part of wider public engagement

processes. These community engagement 'packages' are likely to be more effective than stand-alone 'rewards' measures (Ter Mors et al., 2012). There are some suggestions from the literature as to what such a 'package' approach might entail. In the CCS context, it has been emphasized that in order to build support for a development, local communities should have access to convincing explanations of the merits of CCS and receive responses to public concerns from *trusted* sources (Whitmarsh et al., 2011). Trust is highlighted here as this is a key issue: even developers that want to provide community compensation from genuine selfless intentions can find it difficult to gain the trust of a local community (Walker et al., 2014). Industry and government tend to score low on trustworthiness in a CCS context, while researchers and NGOs are seen as more trustworthy (L'Orange Seigo et al., 2014). If developers partner with local communities and NGOs when communicating with the public this may help to build trust (Lofstedt, 2015). This is supported by empirical research which showed that CCS information written by an environmental NGO and oil company together was seen as of higher quality and more balanced, than information provided by either organization (Ter Mors et al., 2010).

Another important way to build trust is by giving local communities a genuine, meaningful voice during decision-making processes. That is, community compensation is more likely to succeed in terms of getting local communities on board with the development if the host community has control in the decision-making process, rather than only being able to reject or accept a compensation offer (Upham and Pérez, 2015). To facilitate positive public opinion, local publics need to trust that participatory processes organized by a developer or government are meaningful: that their interests will be heard and acted upon (Aitken, 2010a). This is also reflected by the need for socio-political legitimacy, interactional- and institutionalized trust to attain a SLO (Thomson and Boutilier, 2011) – community engagement should involve active listening and responding to concerns to build trust (Dare et al., 2014). This can be done, for instance, through adding smaller scale dialogue-based engagement processes to standard community consultation measures (Coyle, 2016).

When not given a meaningful voice conditional supporters of a development may turn into objectors (Wolsink, 2007). To illustrate, during the planning of a CCS project in the Netherlands (i.e. Barendrecht), members of the public reported low trust in the national government, and the project developer Shell, which in turn related to negative public opinions about the CCS project. Although members of the public were able to voice their concerns and opinions at different stages, there was a general feeling that the government would continue with the project regardless. This feeling was likely strengthened by new regulations that increased the formal decision making power of the national government relative to the local government. This led to an overall sense amongst local people that they had little influence on the final decisions regarding the CCS project (Terwel et al., 2012). These type of consultation processes whereby members of the public are asked to voice their opinion, but their input is not intended to be considered are a form of 'pseudo voice' (De Vries et al., 2012). Importantly, once trust between communities and industry (or other stakeholders) is breached in this way, not only is it difficult to rebuild, it can also cause a negative spill-over effect on perceptions towards other technologies and projects (Gough et al., 2017).

To summarize, as stated by Aitken, 2010a, community compensation is only one aspect of public engagement. Without wider decision-making opportunities that give local publics a meaningful voice during project development, it may do little for public acceptance. Meaningful two-way dialogue is seen as the foundation for trust between communities and developers, and ultimately for public acceptance and SLO (Hall and Jeanneret, 2015; Hodge, 2014; Mercer-Mapstone et al., 2018; Moffat and Zhang, 2014).

2.3. The institutionalization of community compensation

Compared to the previous two sections, this section deals with a more recent discussion within the community compensation literature: the institutionalization or formalization of community compensation practices. With a few exceptions, community compensation practices tend to be relatively ad hoc and lack an institutionalized approach (Aitken, 2010a; Bristow et al., 2012). These exceptions mostly relate to the 'narrow' notion of community compensation based on tort law principles (see Section 1; Jørgensen et al., 2020). So, although in some countries and sectors there is a clear expectation of compensation in some form (Saglie et al., 2020), in general, there is a lack of formal guidelines or structures in place dictating whether and in what format developers of low carbon technologies, subsurface activities and other land uses should offer community compensation. This lack of an institutionalized approach to community compensation has downsides, but also offers benefits.

It has been suggested that community compensation practices should be institutionalized in order to facilitate fair decision-making processes and reduce public suspicions. Previous research has shown that, when there are no formal guidelines in place, companies might be more hesitant to discuss community compensation in detail at an early stage in the project (Aitken et al., 2010a). This can be perceived by the public as a lack of transparency and can associate community compensation with 'bribing' (Aitken, 2010a; Cass et al., 2010). Discussing community compensation at early stages of a project may lead to suspicions that developers are trying to influence the planning process by 'buying support', while offering compensation at later stages might be perceived as a reaction to opposition (Cass et al., 2010). This 'bribing rhetoric' can limit the positive effects that community compensation can have on project support, and there is a need for strategies to prevent this rhetoric (Walker et al., 2014). Institutionalized guidelines could be an effective strategy as it allows community compensation to become standard procedure, rather than a voluntary procedure that can have (perceived) ulterior motives (Aitken, 2010a). In addition, without a legal framework, communities might feel that they lack the power to get their needs and demands heard (Cowell et al., 2012; Kerr et al., 2017). A clear legal framework may give local publics a stronger voice and the guarantee to be taken into consideration in planning and community compensation decisions.

However, this is not necessarily the case as shown in a recent study into two mandatory compensation schemes (i.e. property value loss payments and co-ownership shares) offered to communities near wind parks in Denmark (Jørgensen et al., 2020). Responses to both schemes were met with bribing perceptions, low perceived distributive fairness and counterproductive attitudes towards the project amongst local communities. These responses were rooted in a lack of recognition and disappointment amongst residents as the schemes did not meet the community's needs and expectations. In one case, where a local developer provided another form of compensation alongside the mandatory compensation schemes, distributive fairness and recognition were experienced. This added compensation was developed through community dialogue to ensure that it was seen as relevant and fair. So, when institutionalized community compensation limits opportunities for dialogue between communities and developers this can have a negative impact (Jørgensen et al., 2020).

Furthermore, formal guidelines on community compensation have also received criticism from wind energy developers due to worries about the cost-competitive nature of wind energy, and about an increase in bureaucracy that will add complexity and extra expense (Walker and Baxter, 2017). Moreover, others have noted that formal community compensation approaches can challenge the ambiguity currently associated with compensation. As explained by Cowell et al. (2011) in the context of wind farms, community compensation is: *"characterized by 'constructed ambiguity', in which fluidity of meaning allows the concept to hold together a range of interests surrounding [a] development"* (p. 549).

According to Cowell et al. (2011), this ambiguity is beneficial because when meanings are not formalized different parties can rationalize community compensation to fit their own perceptions. For instance, different levels of government (e.g. national vs. local) might use various motives and terms (e.g. benefits vs. compensation) depending on the audience they are talking to (Kerr et al., 2017). This process *"falters when the ambiguity is challenged by clear, formal public statements of the justification, form and intended recipients of community benefits"* (Cowell et al., 2011; p.549).

Moving forward, the limited studies available tend to recommend the use of a flexible institutionalized approach when it comes to administrating community compensation. In the context of nuclear waste storage, Kojo and Richardson (2014) argue that a mixed approach to institutionalizing community compensation is needed to provide guarantees for local communities and stakeholders on the implementation of negotiated procedures, and at the same time provide flexibility to take into account local interests. In this way, legal controls provide a framework to operate in, while negotiations within this framework make sure local conditions add an essential additional perspective. This approach takes into account that non-monetary values are difficult to assess through legal estimates and project-related flexibility is needed to adjust to the local context (Jørgensen et al., 2020). Thus, research suggests that institutionalization should not limit opportunities for negotiations between local communities and developers to decide on the level, form and distribution of community compensation based on specific local needs (cf. Cowell et al., 2011).

2.4. Community compensation for onshore and offshore developments

The fourth and final debate in this review concerns community compensation for onshore and offshore developments. In general, even when it is not legally imposed there is a tacit acceptance among developers to offer some form of community compensation for onshore developments (at least for wind energy), but the same cannot be said for offshore developments (Kerr et al., 2017). When it comes to offshore developments there are various issues at play. First, identifying the relevant community is more complex for offshore projects and may lead to problems when it comes to public engagement. For instance, the lack of an obvious host community prevents the development of a long-standing relationship between industry and local publics (Gough et al., 2018). At the same time, communities may feel less able to challenge or oppose a project (Cowell et al., 2012), and have little leverage in terms of property rights (Kerr et al., 2017). Second, the lack of community compensation within the offshore context has been linked to the relative infancy of the offshore industry (at least when it comes to low carbon technologies such as offshore wind); as 'emergent technologies' it has been argued that project economics not yet allow for community compensation (Cowell et al., 2012; Kerr et al., 2017). Finally, it has been suggested that developers or authorities may assume that harms to communities are lower for offshore developments – perhaps making offshore developments easier to site (Cowell et al., 2012; Lofstedt, 2015).

Research on the difference, in terms of public perceptions and acceptability, between onshore and offshore developments has primarily focused on wind energy. Offshore wind is commonly portrayed as a problem-free, acceptable alternative to onshore wind energy by scholars, policy makers as well as developers (Haggett, 2008, 2011). However, studies have shown that the factors that influence public responses to offshore wind energy are largely the same as those that influence public responses to onshore wind energy. There is no support for a universal preference for offshore developments over onshore developments, rather public preferences depend on the local context such as trust in local stakeholders and opportunities for participation (Dalton et al., 2008; Ek, 2006; Haggett, 2008, 2011; Ladenburg, 2008; McCartney, 2006; Veidemane and Nikodemus, 2015; Wiersma and Devine-Wright, 2014).

Moreover, research has highlighted factors that may be important in shaping public responses, in the offshore context specifically. 1) conflicts of use due to the dynamic use of the sea by many users simultaneously; 2) issues around ownership, as the sea(bed) is not often privately owned; 3) conflicting ideas of what the sea represents and can be used for (Gray et al., 2005; Kempton et al., 2005). The latter factor in particular also influences the need for, and form of, community compensation in the offshore context. This topic brings us back to the discussion of place meanings (see Section 2.1). For many people the sea has a distinct sense of place and associated values. Values that have been identified include: 'openness', 'wide' and 'wilderness' (Gee, 2010), as well as the idea that 'no one owns the ocean', and that it 'belongs to the public' (Kempton et al., 2005). Industrial developments are seen to threaten these values – turning the sea, a place where human structures do not belong, into an industrial area (Gee, 2010; Kempton et al., 2005). Interestingly, traditional more transient activities (e.g. fishing, shipping) are often seen in a different light, perhaps because they are perceived to fit historical uses of the sea. Industrial developments on the other hand take the form of more large-scale (semi)permanent structures that are perceived to destroy qualities that make the sea a special place (Gee, 2010).

In the CCS context there are very few studies on the difference between public responses to, and community compensation for, onshore and offshore developments. Although there are examples of offshore CCS developments which have led to little public resistance, the research available suggests that acceptability is not a given when CO_2 is stored offshore rather than onshore (cf. Schumann et al., 2014). In a study on CCS storage options among the German public CO_2 storage was seen as a slightly better option than onshore storage among the general public, but citizens of coastal regions were equally negative about both storage options (Schumann et al., 2014). Thus, suggesting an important role for public engagement, including community compensation, for both on- and offshore developments.

In the context of CCS developments other scholars have also noted that although there may not be a local affected community for offshore storage, there can be a broader community of interest (Gough et al., 2018). So, when it comes to deciding on community compensation for offshore storage it may be more relevant to look at defining community in terms of interest rather than place. Furthermore, even when storage sites are offshore, a large part of the CCS infrastructure is likely to still be onshore (e.g. transport pipelines; Shackley et al., 2009). So, in addition to the points mentioned above, onshore infrastructure related to offshore developments can also elicit public concern, and further influence public responses to offshore developments. In conclusion, based on the research available it seems that when designing community compensation measures, it is relevant to consider impacts from onshore- as well as offshore infrastructure.

In sum, the academic literature on community compensation was summarised into four debates. The first two debates (i.e. finding a fit and public engagement) have received a lot of attention over the years and there tends to be a relative consensus in the literature with regards to best practices. The final two debates (i.e. institutionalization and onshore/offshore) have emerged more recently. Next, we move away from the academic literature and turn to examples of current practices in community compensation to get a further insight into what form community compensation measures could take in the context of CCS.

3. Community compensation in practice

As mentioned at the start of this paper, when it comes to designing community compensation measures in the CCS context we need to learn from relevant projects and technologies and ensure that important insights are used. This is achieved in part through a review of the academic literature as presented in Section 2. However, additional lessons can be learned from current practices in community compensation within other relevant sectors. There are many parallels between the siting of CCS developments and developments in other sectors (see Section 1); thus its

very likely that similar community compensation practices will also apply to CCS once the technology is implemented more widely. In Section 3.1 a scoping review of publicly available documents (from governments, NGOs and industry) on community compensation practices provides the basis for a discussion on a number of important topics coming out of the academic literature review. Specifically, we discuss examples of defining communities in terms of place, impact and interest; we discuss examples of different approaches taken to decide on the form of compensation, as well as ways to embed community compensation within wider public engagement measures; and finally, we discuss examples of flexible institutionalized approaches to community compensation. The discussion of compensation for offshore projects is not included in this part of the paper due to the limited number of available documents.

By linking the examples to the academic literature review we discuss which lessons can be learned from other sectors and which potential pitfalls to avoid when implementing community compensation measures in the CCS context. Here it is also relevant to consider the cultural context in which future CCS community compensation policies would be implemented. To this end, this part of the paper offers examples of current compensation practices in four European countries: the Netherlands, United Kingdom, Germany and Romania. These countries were selected as this paper was written in the context of the ALIGN–CCUS project (alignccus.eu) - an interdisciplinary research project working on interlinking areas of research into CC(U)S – the four countries are all part of the social science work package within this research project. These countries differ in current, and historical, policies with regards to CCS – providing different contexts for the use of community compensation measures. As mentioned at the start of the paper, The Netherlands and the United Kingdom saw cancellations for a number of large CCS demonstration projects since the early 2000s (EZK, 2017; Haszeldine, 2012; Littlecott, 2012). More recent policies are now targeted at storing CO_2 offshore from industry sources (HMG, 2018; Klimaatakkoord, 2018). In Germany on the other hand a CCS law was enacted in 2012 after a long and conflict-ridden process; although this law allows the research and development of CCS technologies it practically prohibits the demonstration of their commercial usage (Fischer, 2014). However, there is policy support for CCU (Carbon Capture and Utilization) technologies (Mennicken et al., 2016). Finally, in Romania, CCS development is at an even earlier stage. Although there are now some governmental programs that explicitly encourage capture and storage of CO_2, especially for industrial companies (e.g. The National Program for Capture and Storage of CO_2; The National Action Plan for Climate Change and Economic Growth with Low Carbon Emission 2014–2020) specific and clear measures to implement CCS are not yet in place.

3.1. Learning from current practices in community compensation

Beforehand it should be noted that it was not within the scope of this paper to conduct an exhaustive review of current practices in community compensation, so this section should not be interpreted as a such. However, efforts were made to ensure all relevant documents were collected that were in line with the inclusion criteria described in Section 3.1.1 below. Also, the differences between the four countries will not be discussed in-depth as the limited documents available (see Section 3.1.1) did not allow for a thorough cross-country comparison. However, where interesting differences were observed this is highlighted.

3.1.1. Methodology

To collect relevant documents containing practices in community compensation, one researcher from the Netherlands, the United Kingdom, Germany and Romania searched for online documents that adhered to the following inclusion criteria:

1) The document describes guidelines for implementing community compensation in the context of low carbon technologies (e.g. CCS, renewables, nuclear energy), subsurface activities (e.g. gas extraction) and other land uses that impact local publics (e.g. infrastructure, landfills), i.e. either implemented policies or a document advising on how community compensation could be implemented;
2) The document is publicly available online;
3) The document is published outside the academic literature, i.e. documents published by public sector actors (e.g. government), NGOs, or relevant commercial actors (e.g. energy companies; consultancies advising the government).

These criteria were phrased relatively broad on purpose as it was expected that there might be limited documents available describing community compensation practices. This was confirmed by the small number of documents found in each country, and the lack of documents on CCS. In total, twenty-five documents were reviewed from the Netherlands ($N = 4$), United Kingdom ($N = 9$), Germany ($N = 7$) and Romania ($N = 5$). Further details on the documents can be found in the Appendix, along with a complete list of the documents (Table A1 in the Appendix). The twenty-five documents used in this part of the paper could be divided into three categories: advisory documents written to advise governments/developers on their practices (9/25 documents), implemented governmental policies (9/25 documents), and implemented organisational policies (7/25 documents). Within the implemented policies category nine documents described a mandatory provision of community compensation, i.e. regulated by law. Furthermore, the twenty-five documents discussed community compensation in the context of renewable energy technologies, mining, grid extensions, nuclear power, infrastructure, shale gas and natural gas extraction (see Fig. A1 in the Appendix).

After collecting the documents, each researcher reviewed the documents using a template form (including questions such as: how is the community defined; how is the type of community compensation determined; how is the provision of community compensation regulated). Detailed instructions ensured that the template form was interpreted in the same way by all researchers. The principal researcher used a mixture of content and explorative thematic analysis on the completed forms to draw out themes and examine their frequency.

3.1.2. Scoping review

In this section examples taken from the practices reviewed here regarding defining the community, approaches to deciding on the form of community compensation and, related to this, ways to embed community compensation within wider public engagement are discussed. The section ends with examples of flexible institutionalized community compensation approaches.

In the academic literature three ways of defining the community were identified (i.e. place, interest and impact, see Section 2.1; Bristow et al., 2012). How these definitions are used in practice, and how this could be applied to the CCS context, becomes clearer when looking at examples of each community definition from the documents reviewed here. Overall, twenty out of twenty-five documents provided a specific description or definition of the target community, while five out of twenty-five documents did not provide this information. What is noticeable is that the use of ‘communities of place’ was fairly common (12/25 documents). These definitions ranged from fairly general descriptions, e.g. those living within or close to the community where a wind park project is being developed (DGE5; Table A1 in the Appendix); to more specific, e.g. owner or main occupant of a residence within two kilometres of a (planned) windfarm (DNL23; Table A1). In the CCS context a similar approach could be taken, however there is an important distinction to be made here between CCS and windfarms. CCS technology constitutes of different elements (i.e. capture, and on/offshore transport and storage) which take up a much wider geographical area (Gough et al., 2018). So, one of the questions here is what aspect of

the CCS technology to take as a starting point in defining a range wherein the relevant community falls.

Definitions of 'communities of impact' (4/25 documents) may seem a better fit in the CCS context as it does not require defining a geographical range. In the practices reviewed here community was defined as, for instance, individuals impacted by mining pollution (DRO17; Table A1), or individuals who suffer damage from infrastructure developments (DNL25; Table A1). However, this way of defining the relevant community was critiqued in the academic literature as a development can have many different impacts (Bristow et al., 2012; Cowell et al., 2012). Relating this to the latter example for instance, damage is deemed to be the only 'valid' reason for community compensation, while infrastructure developments can also lead to other impacts, e.g. change of landscape (e.g. aesthetic impact), or economic (e.g. property values).

An interesting observation with regards to 'communities of interest' was that, in the practices reviewed here, this approach was combined with identifying the community in terms of place and/or impact (4/25 documents). Perhaps this combined approach can also offer opportunities in the CCS context by overcoming some of the issues highlighted above. For instance, in a Scottish government policy report on community compensation for onshore renewable energy developments (DUK8; Table A1) an extensive 'community identification process' is described whereby developers, through an initial study, define a geographical area which should benefit from community compensation. Following on from this process, developers are instructed to identify communities of interest (groups and individuals) within that boundary who need to be part of the consultation process – as well as speak to these communities and individuals to determine whether there are other relevant contacts that should be consulted.

Next, we turn to examples of ways to decide on the form of community compensation. As mentioned in Section 3.1.1 the scoping review included advisory documents as well as implemented governmental and organisational policies. It should be noted that these implemented policies did not necessarily set out the minimum legal requirements for community compensation (or engagement), however 10 out of 16 documents did describe specific conditions under which a certain amount of compensation was offered. Often this was combined with other processes to decide on the form of community compensation which will be outlined next. Coming back to the academic literature, meaningful community discussion and insight in local circumstances were identified as key elements to facilitate a fit between the form of compensation and local needs and concerns (see Section 2.1). On this topic, the practices reviewed here highlight how the cultural context may play a role in what form this community discussion may take. Determining community compensation through a consultation process with (local) stakeholders was fairly common (8/25 documents) – particularly in the Netherlands and the UK. For instance, an implemented organisational policy on gas extraction in the Netherlands states that, with regards to community compensation, the developer will provide knowledge and resources to make a 'positive contribution to the environment'. What this 'positive contribution' entails should be determined in consultation with the local stakeholders (DNL22; Table A1). Sometimes community consultation may play a smaller room but is still deemed important such as in this example from the wind energy sector in the UK. In this case, community compensation is decided upon in collaboration with the communities of interest, although the document also notes that the offer is predominantly decided by the developer based on what the company can afford, legal advice and if the developer has previous community compensation arrangements (DUK14; Table A1). On the other hand, in the documents from Romania community compensation is solely based on legal requirements, i.e. community compensation is determined by governmental departments without a mention of stakeholder consultation.

An example of a similar cultural difference can be seen when looking at the way in which the practices in community compensation reviewed here are embedded within wider public engagement strategies. In the academic literature there is a general consensus that community compensation is more effective in supporting facility siting when embedded into wider public engagement strategies (cf. Aitken, 2010a; Section 2.2). Examples of this embedded approach can be found in the documents reviewed here (9/25 documents), but there are also instances where community compensation is used as a stand-alone measure (11/25 documents). This high number of stand-alone measures is mainly due to the fact that community compensation was described as a stand-alone measure for all the Romanian documents. In the other countries, some form of public engagement alongside community compensation was more common. From this we can see an example of the 'package' approach (as described in the literature, see Section 2.2) in the context of gas extraction in the Netherlands (DNL22; Table A1). According to the implemented organisational policy a project coordination programme should be set up for each development in consultation with local authorities in order to connect with surrounding communities. This programme should fit the wishes and needs of surrounding communities, of which one element is the provision of community compensation to mitigate negative impacts. Although this example recognises the need to connect with local communities in other ways alongside community compensation, it is worth observing that the project coordination programme is set up in consultation with local authorities rather than, for instance, community representatives. One could question whether this gives local communities a genuine, meaningful voice (cf. Dare et al., 2014; Upham and Pérez, 2015) during the decision-making processes that are part of a new development. So, when designing community compensation measures in the CCS context it may be important to consider how to involve communities more directly. One example is by using community compensation as an opportunity to further engage with the public (5/25 documents). In contrast to the previous example, here community compensation was the reason for further engagement with the public, rather than community compensation only being one element of broader public engagement strategies. For instance, there might be an opportunity for the community to get involved in various aspects of setting up community compensation (e.g. design, allocation of funds; DUK16; Table A1), community compensation is seen as a way to link into community aspirations and find ways to support long-term sustainable development (DUK14; Table A1), or a way to bring communities together (to discuss funding opportunities; DUK9; Table A1). Offering community compensation in this manner will likely have a positive effect on perceptions of procedural fairness with regards to community compensation (i.e. a judgement of the process by which decisions are made; see Section 2.2), as it goes some way towards involving local communities in the decision-making processes surrounding a development. However, without a wider public engagement strategy, the question remains whether this will be enough to build a feeling of trust towards the developer.

Finally, in the academic literature institutionalizing community compensation has been suggested as a way to build trust relationships between communities and developers, and reduce some of the negative connotations associated with community compensation (e.g. bribing). This is a relatively novel debate in the literature and it is interesting to look at how this is reflected in the field, and what this may mean for future community compensation practices in the CCS context. In nine out of twenty-five documents reviewed here, the provision of community compensation was mandatory, i.e. regulated by law. For the remaining sixteen documents, community compensation was not regulated at all, or only in part. This is in line with the ad hoc approach towards community compensation identified in the academic literature (Aitken, 2010a; Bristow et al., 2012). A common case is illustrated by an example from offshore renewable energy developments in the UK (DUK11; Table A1); here the provision of compensation is a voluntary arrangement. However, it is advised that all agreements are provided in writing between relevant parties at an early stage in the process, followed by the signing of a legally binding document. In the academic literature a flexible institutionalized approach is mentioned as a possible

effective way to regulate community compensation (cf. Kojo and Richardson, 2014). Although the example above seems to align with this approach, it combines voluntary compensation with a more regulated negotiation procedure rather than mandatory compensation with a more voluntary negotiation procedure (the procedure preferred in the academic literature). A question to keep in mind when designing future community compensation practices in the CCS context, is whether setting up legal agreements at an early stage still allows for flexible negotiation procedures incorporating local needs at a later stage. It is also worth noting that in the documents reviewed here highly regulated community compensation practices were less likely to include a wider public engagement strategy compared to more voluntary community compensation practices. In fact, out of the nine community compensation practices that were regulated by law, only one document described some form of public engagement alongside community compensation (DGE7; Table A1). This observation is in line with one of the downsides of institutionalizing community compensation mentioned in the academic literature, namely: limiting opportunities for negotiations between local communities and developers (cf. Cowell et al., 2011). Despite what was suggested in Section 2.3, it shows that a clear legal framework does not necessarily give local publics a stronger voice. Thus, highlighting the need to safeguard negotiation opportunities when designing community compensation measures in the CCS context.

4. Discussion and conclusion

After a number of CCS projects were cancelled at the start of this decade, CCS is now back on the policy agenda in several European countries. However, as projects move towards the implementation stage there are still many questions around how to build public support and deal with local opposition. Effective public engagement will be key for successful CCS implementation, with this comes a need for further insights into how to most effectively engage with local publics. A lot can be learned from looking at related technologies, and examining how the knowledge gathered here can be applied to the CCS context. In this paper we examined the role of one aspect of community engagement in particular: offering community compensation as a way to balance local benefits and perceived negative impacts. The academic literature on community compensation in the context of CCS and other low carbon technologies (e.g. renewables, nuclear energy), subsurface activities (e.g. gas extraction) and land uses that impact local publics (e.g. landfills) was reviewed and summarised into four debates. Furthermore, a look at current practices in community compensation for four European countries provided further insight into important aspects to consider when designing community compensation measures to facilitate the future siting of CCS projects. Bringing together the academic literature review and discussion of current practices we can come to a set of lessons and knowledge gaps with regards to implementing community compensation in the context of CCS (summarised in Fig. 1).

4.1. Lesson 1: Fit compensation with local needs and concerns

Community compensation is more likely to be accepted by local publics and aid towards positive perceptions of the CCS project if the form of compensation aligns with local needs and concerns. Following on from this, there is as need to understand local social circumstances, such as insight into what a specific place, community or landscape means to local publics – as well as how CCS technology may impact these meanings - at an early stage of the project. In this way the right form(s) of compensation can be found to account for a perceived threat to (local) values.

This idea of place-technology fit (cf. Devine-Wright, 2013;

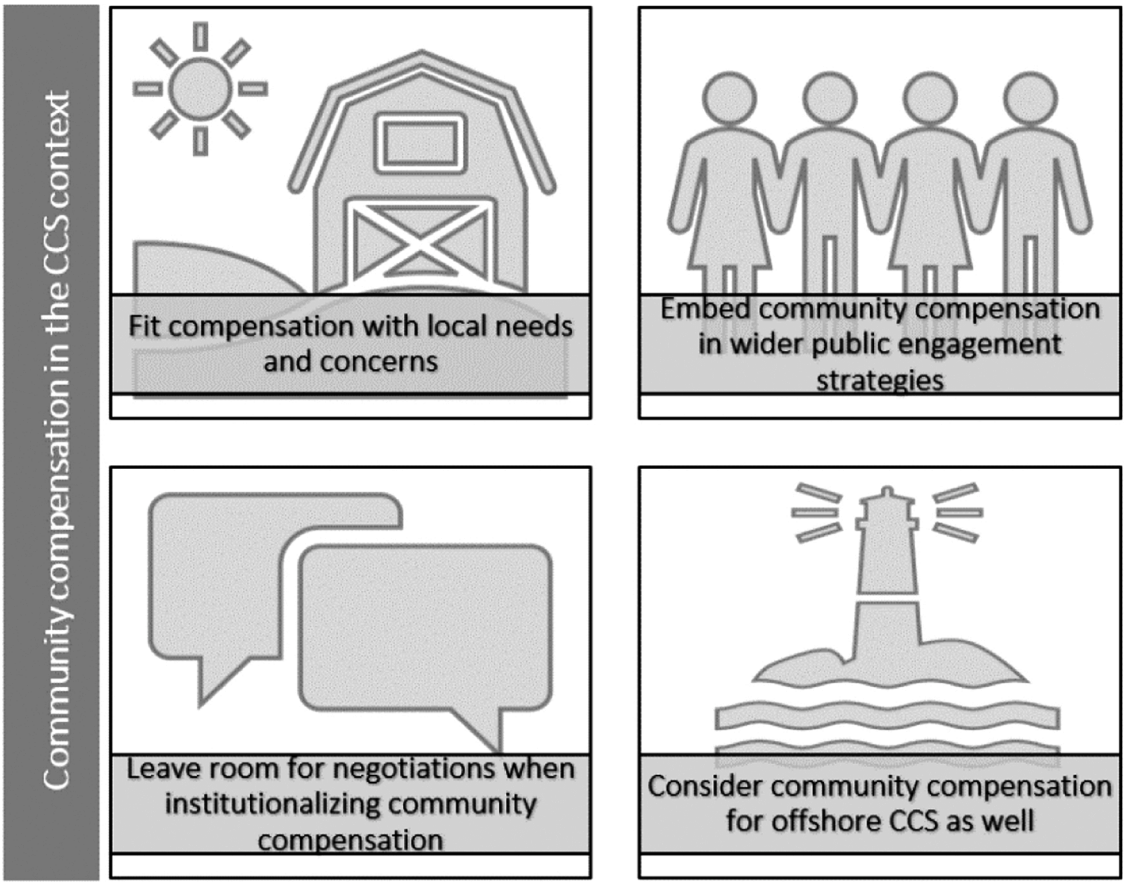

Fig. 1. Lessons on community compensation in the CCS context.

Pasqualetti et al., 2002) has received little attention in the CCS literature so far, and further insight is needed into the meanings associated with CCS technology and how this could affect, or pose a threat to, place-related meanings. From previous research in related fields we know that the way a technology is viewed is likely to be locally dependent and linked to previous experience with the technology. This may lead to questions such as whether areas with an industrial heritage, where local publics might feel an attachment to industry, are more positive towards a CCS development. Further knowledge gaps remain as to how different ways of defining the relevant community might impact the use and form of compensation. To illustrate, when communities are selected on the basis of whether they are impacted by the project: which impacts should count, and how can impacts in one domain be compensated by measures in another domain? Also, relevant communities are often decided upon based on location, bringing forward the question whether this approach is feasible in the CCS context where capture, transport and storage cross different areas.

4.2. Lesson 2: embed community compensation in wider public engagement strategies

There tends to be agreement in the literature that in order for community compensation measures to be effective they should be embedded in public engagement strategies (e.g. education, consultation, deliberation). Building support is not just about correcting imbalances, it is also about, amongst others, fair decision-making processes and fostering trust through giving local publics a meaningful voice.

Knowledge gaps remain regarding the most effective ways to gain the trust of the local community, and how to overcome perceptions of 'bribing' when it comes to offering compensation. This is especially important in the CCS context where negative or mixed public perceptions of the technology (cf. Shackley et al., 2009), and a history of cancelled demonstration projects in many European countries may fuel distrust in developers of future CCS projects.

4.3. Lesson 3: leave room for negotiations when institutionalizing community compensation

Currently, there is a lack of formal guidelines on community compensation, practices are mostly ad hoc and voluntary, which could contribute to the 'bribing rhetoric' around community compensation. The literature suggests that institutionalizing community compensation may help towards building better trust relationships and moving away from negative connotations associated with community compensation (i.e. bribery). A flexible institutionalized approach, allowing for negotiations and dialogue between local communities and developers regarding the type and amount of compensation, may work best here.

Future research should examine how community compensation in the CCS context can be formalized while, at the same time, opportunities for negotiations remain. Also, there is still limited empirical evidence around the impact of institutionalization on the effectiveness of community compensation (and other public engagement measures). Future research could look into whether support for CCS developments differs depending on whether community compensation is offered on a voluntary or mandatory basis.

4.4. Lesson 4: consider community compensation for offshore CCS as well

From the authors' personal experience, the common narrative in the wind energy sector that offshore projects are an easy alternative to onshore projects when it comes to public support (Haggett, 2008, 2011) is also present in the CCS sector. However, it is important to recognize that there is no support in the academic literature for this universal preference for offshore developments over onshore developments. So, we cannot assume that CO_2 storage or transport will automatically be more easily accepted by the public when placed offshore. Moreover, compared to many other low carbon technologies, subsurface activities and land uses, CCS with offshore storage provides a challenging situation in the sense that large parts of the relevant infrastructure are both onshore (i.e. capture, transport), and offshore (i.e. transport and storage). As such, when designing community compensation measures in a CCS context, it is recommended to consider compensation for impacts of onshore as well as offshore infrastructure.

In terms of knowledge gaps there is little experience with offering community compensation in the context of offshore developments. There is also limited research on public responses to offshore (as compared to onshore) aspects of CCS, as well as the role that community compensation could play for offshore developments. Future research may examine whether public responses to offshore CCS infrastructure, and the need for community compensation, vary depending on whether new or existing infrastructure is used (e.g. depleted gas fields as storage sites), and to what extent a preference for certain forms of community compensation depend on a person's connection with, or attachment to, the sea.

4.5. Limitations

Before we conclude the paper, some limitations need to be recognized. Although effort was made to provide a comprehensive overview of the academic literature and current practices in community compensation, it was not within the scope of the current research project to conduct a fully exhaustive 'systematic review'. This should be taken into account when interpreting the conclusions presented here. Furthermore, throughout this paper we discuss lessons learned from other sectors, such as other low carbon technologies (e.g. renewables, nuclear energy), subsurface activities (e.g. gas extraction) and land uses that impact local publics (e.g. infrastructure, landfills). Although there is overlap between these sectors, as discussed in Section 1, we should also not assume that findings in other sectors will be the same in the CCS context. For instance, a factor that may be important here is that for many people CCS is still an unfamiliar technology compared to more common technologies such as wind energy (cf. Parkhill et al., 2013).

4.6. Conclusion

In conclusion, this paper highlights the complex nature of implementing CCS into society and the importance of careful consideration of local contexts and needs when it comes to designing community compensation measures. It offers useful lessons learned from related sectors that can be applied to ensure community compensation is practised more effectively to engage with local publics around CCS developments. Furthermore, the identified knowledge gaps put forward here provide opportunities for future research. This paper was written in the context of the ALIGN–CCUS research project (alignccus.eu), within this project some of the knowledge gaps and research questions identified here will be addressed through interviews with community engagement managers about their experiences with community compensation measures, along with quantitative studies testing the effectiveness of different compensation schemes. By conducting further research we can work towards making the distribution of impacts for implementing CCS more equal across society while supporting much needed reductions in CO_2 emissions.

Declaration of Competing Interest

The authors report no declarations of interest.

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Appendix A. Supplementary data

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